LLNL Environmental Restoration Division (ERD)
Standard Operating Procedure (SOP)

# ERD SOP 2.6: Sampling for Volatile Organic Compounds—Revision: 5

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## 1.0 PURPOSE

The purpose of this SOP is to provide guidance on the collection of a ground water sample to be analyzed for volatile organic compounds (VOCs). The objective is to provide the laboratory with a sample that is representative of its original environment.

## 2.0 APPLICABILITY

This SOP applies to the collection of ground water samples to be analyzed for VOCs. Due to the volatility of such compounds as Trichloroethylene, extra care should be taken during sample collection to ensure sample integrity.

## 3.0 REFERENCES

3.1 Morse, S. I. (1997), San Francisco Bay Regional Water Quality Control Board, Toxics Cleanup Division; letter to Interested Parties. Subject: *Utilization of Non-Purge Approach for Sampling of Monitoring Wells Impacted by Petroleum Hydrocarbons, BTEX, and MTBE,* File: 1123.64, January 31, 1997.

3.2 Robbins, G. A., and J. M. Martin-Hayden (1991), Mass Balance Evaluation of Monitoring Well Purging: Part 1. Theoretical Models and Implications for Representative Sampling," *J. Contam. Hydrol.* 8, 203–224.

3.3 Schilling K. E. (1995), Low-Flow Purging Reduces Management of Contaminated Groundwater, *Environmental Protection*, December 1995.

3.4 U.S. EPA (1985), *Practical Guide for Groundwater Sampling*, Washington, D.C. (EPA/600/2-85/104).

3.5 U.S. EPA (1986), *RCRA Groundwater Monitoring Technical Enforcement Guidance Document*, Washington, D.C. (OSWER-9959.1).

3.6 U.S. Environmental Protection Agency (EPA) (1995), Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures, *Ground Water Issue*, EPA/540/S-95/504.

3.7 U.S. Environmental Protection Agency (EPA) (1995), *Use of Low-Flow Methods for Ground Water Purging and Sampling: An Overview*, Quick Reference Advisory (December 1995).

## 4.0 DEFINITIONS

See SOP Glossary.

## 5.0 RESPONSIBILITIES

### 5.1 Division Leader

The Division Leader's responsibility is to ensure that all activities performed by ERD at the Livermore Site and Site 300 are performed safely and comply with all pertinent regulations and procedures, and provide the necessary equipment and resources to accomplish the tasks described in this procedure.

### 5.2 Field Personnel

The field personnel are responsible for the safe completion of evacuating and sampling ground water monitor wells according to guidelines set forth by this procedure and associated SOPs.

### 5.3 Field Support Personnel

The field support personnel's responsibilities are to provide the appropriate equipment, collection devices, and general field support to assure that field activities are performed in a timely and efficient manner. Field support personnel are also responsible for adhering to all applicable ERD SOPs.

### 5.4 Sampling Coordinator (SC)

The SC's responsibilities include providing the following: A quarterly Sampling Plan, a specific sample plan for each day (Daily Operations Guide [DOG], SOP 2.1, "Pre-sample Purging of Wells," Attachment A), all necessary technical information required for purging wells, and electronically generated Ground Water Sampling Data Sheets (SOP 2.1, Attachment C).

### 5.5 Subproject Leader (SL)

The SL is responsible for the overall investigation, planning, and assessment and remediation within a study or treatment facility area.

## 6.0 PROCEDURE

Because laboratory methods are extremely sensitive, well controlled, and quality assured, sample collection should also be performed following comparable procedures. The proper collection of a sample to be analyzed for dissolved VOCs requires minimal disturbance to the sample in order to limit volatilization, and produce a representative sample.

### 6.1 Preparation

6.1.1 Prior to commencement of field activities, perform preparation activities described in SOP 4.1, "General Instructions for Field Personnel." Personnel shall meet all training requirements, review the appropriate Site Safety Plan (SSP), and all applicable SOPs, Operational Safety Procedures (OSPs), and Integration Work Sheets (IWSs) prior to performing work. Current copies of all relevant documents shall be retained by the field personnel.

6.1.2 Review all pertinent sampling information, such as the quarterly Sampling Plan, Well Specification Table, Technical Information Spreadsheet, and electronically generated Ground Water Sampling Data Sheets (if applicable) provided by the SC. The plan contains the following information:

- Locations to be sampled.
- Proposed sampling methods (See SOP 2.1 Attachment B, Methodology Sampling Codes).
- Requested analyses.
- Contract analytical laboratory (CAL) to which samples are to be sent for analyses.
- Estimated amount of purge water to be collected.
- Current technical information for each well.

6.1.3 Obtain appropriate data collection forms i.e., Chain-of-Custody (CoC) forms, Ground Water Sampling Data Sheets (SOP 2.1, Attachment C), assigned Document Control Logbook, labels, and any necessary shipping forms. Instructions for completing the logbook entries and field forms are provided in SOP 4.2, "Sample Control and Documentation. Consult with the SC for the appropriate pre-sample purging method to apply to the site if it is not indicated on the sampling plan.

6.1.4 Contaminant information is provided in the quarterly Sampling Plan or by the SC and should be reviewed prior to sampling. At Livermore Site, the SC checks the most recent analytical results prior to providing guidance to sampling personnel as part of the DOG (SOP 2.1 Attachment A). The SC will also provide contaminant information for newly completed installations that may not appear on the plan.

6.1.5 Obtain appropriate materials to conduct field work according to Attachment D, Equipment Checklist in SOP 2.1.

6.1.6 The number and type of sample containers needed for the sampling event should be obtained from the sample bottle inventory. The appropriate personnel should

keep a sufficient stock of sample containers on hand. Field personnel should also maintain an inventory of supplies (i.e., trip blanks, field blank water (ordered from the CAL), plastic bags, etc.), to ensure adequate sampling supplies are available at all times.

6.1.7 Organize sampling route:

A. Site 300

1. Complete an entire study area before beginning the next, when possible.
2. Proceed to sample wells, working from the least contaminated to the most, when possible.

B. Livermore Site

The Livermore Site SC will specify the order of well sampling. Livermore Site contains overlapping study areas which are not hydrogeologically isolated. When working with portable equipment, sample wells from the least to the greatest contaminant levels, as directed, by the SC.

6.1.8 The Administrative Escort Services must be given a 24-hour notice (at a minimum) before work is scheduled in restricted areas.

6.1.9 Enter the required information on the Ground Water Sampling Data Sheet and Document Control Logbook per the instructions in SOP 4.2, "Sample Control and Documentation." When using the electronically generated Ground Water Sampling Data Sheets all the initial information is already provided and should be checked.

## 6.2 Purge Water Collection

6.2.1 At Site 300, the field support personnel must ensure that wells have sufficient collection drums available at the well head for purge water containment (SOP 4.7B, "Site 300 Treatment and Disposal of Well Development and Well Purge Fluids"). The quantity of purge water to be collected for each well is listed in the quarterly Sampling Plan or calculated by the SC for newly installed monitor wells.

6.2.2 The Livermore Site field personnel will tow a collection tanker with the sampling vehicle and when necessary, the SC may provide a specific order of wells to be sampled. Tankers and drums filled with purge water may not be left at the well location and will be logged and disposed of daily, when possible according to SOP 4.7A, "Livermore Site Treatment and Disposal of Well Development and Well Purge Fluids."

## 6.3 Operation

6.3.1 Purge well prior to sampling as specified in SOP 2.1. Obtain water quality parameters in accordance with SOP 2.2, "Field Measurements on Surface and Ground Waters."

6.3.2 Sample retrieval systems suitable for the valid collection of volatile organic samples include positive displacement bladder pumps, gear-driven submersible pumps, specific-depth grab sampling devices and bailers. Field conditions and other constraints will limit the choice of appropriate systems. A sample subjected

to the least amount of turbulence possible remains as the objective in collecting a representative sample for analysis.

A. Sample Retrieval-Bladder Pump

These pumps are used in wells producing a sustainable yield of <1.0 gallons per minute (gpm), where the casing depth does not exceed 150 ft, and where there is not a significant quantity of water to remove. These pumps require a power supply and a compressed gas supply or compressor. They may be operated at variable flows (under 0.5 gpm), making them acceptable for purging and sampling wells in low-yielding aquifers.

1. Label vials with appropriate sample information. Open vials and set caps in an upright position in a clean place. Collect the sample during the middle of the cycle. Collect one volatile organic analysis (VOA) vial at a time to avoid spillage and possible breakage. Reduce the discharge pressure on the controller to minimize volatilization of the sample. Sample should be collected over a collection vessel such as a tray, bucket or collection drum to avoid spillage to ground when contaminants are present in the ground water. Contamination information is included in the Sampling Plan and the electronically generated Ground Water Sampling Data Sheets for Site 300. For the Livermore Site, contamination information is available in the DOG provided by the SC.
2. Hold the edge of the sample line at the top edge of the sample vial and allow the water to run down the inside into the vial. Do not allow the discharge tube to touch the sample vial or the water to drop or fall into the vial; avoid splashing. The proper collection of a sample for dissolved VOCs requires minimal disturbance of the sample to limit volatilization and, therefore, a loss of VOCs from the sample.
3. Do not rinse the vials or excessively overflow them. There should be a convex meniscus on the top of the vials. Check that the caps have not been contaminated (splashed) and carefully cap the vials.
4. Invert the vials and tap gently. No entrapped air should be left in the sample vial. In some instances, a well can have natural off-gassing which can produce gas bubbles in the sample. In these cases of natural off-gassing, the sample should sit open to allow the gas to coalesce, then top off the sample until a convex meniscus forms and gas bubbles disappear.
5. Place the samples in airtight plastic bags in a cooler containing bagged ice, loose cubes, or bagged blue ice. Loose ice should be replaced with bagged ice or bagged blue ice before shipping. Samples should be maintained at 4°C ± 2°C. Include a temperature blank and a trip blank for the analytical laboratory.

B. Sample Retrieval—Submersible Pump

Electric submersible pumps are used to quickly and efficiently purge large quantities of water. The flow rate is controlled at the surface by an in-line ball valve attached to a sample tee or controlled by the use of a rheostat. Samples are collected from a small diameter ®Teflon tube. Care must be exercised when sampling for VOCs to avoid possible splashing and aeration.

1. Place the generator downwind from the well. Water levels should be monitored frequently to ensure the water level does not drop below the pump intake or screened interval when possible.
2. Attach the dedicated sample tee (found inside the protective steel casing) to the discharge pipe. Start the generator. Adjust the discharge rate by partially closing the ball valve on the sample tee so that the well will yield water without exposing the screen when possible. If using a rheostat equipped pump, the discharge rate is controlled by the pump speed adjustment knob on the controller unit.
3. Follow steps in Section 6.3.2A steps 1 through 5.

C. Sample Retrieval—Bailers

Where approved by the SC, it is acceptable to use a Teflon, stainless steel, polyethylene, or polyvinyl chloride (PVC) bailer. SOP 2.1, "Pre-sample Purging of Wells," Attachment E is a schematic of a typical bailer. Collection of an equipment blank sample may be necessary when using a reusable bailer, consult SOP 4.9, "Collection of Field QC Samples" for this determination.

1. The retrieval line should be securely attached to the bailer. A new rope should be used at each well, unless the bailer is dedicated. Dedicated bailers should be checked for cracks and breaks and replaced when necessary.
2. The free end of the retrieval line should be fastened to the protective casing or secured by the sampler to avoid losing the bailer in the well.
3. Lower the bailer gently into the well and begin water removal. Avoid unnecessary agitation of the water. Collect or dispose of purged water in acceptable containers as specified in SOP 4.7A or SOP 4.7B.
4. To collect a sample from the bailer, a bottom emptying device is inserted into the bottom of the bailer which expels the water. Again, use caution when filling sample VOA vial (SOP 2.4, "Sampling Monitoring Wells with a Bailer").
5. Follow steps in Section 6.3.2A steps 1 through 5.

D. Sample Retrieval—Specific-Depth Grab Sample Device

These devices obtain samples at a specific depth within the water column. The procedure is to lower the device to the depth specified by the SC and or SL, usually the mid-point of the screened interval. The device is then activated and two or more sample chamber volumes are drawn through the bailer. The sample is isolated from the water column by shutting off the pump. This closes the double-check valves and allows the sample to be retrieved. The device is retrieved and the sample is transferred to sample vessels as outlined in Section 6.3.2A steps 1 through 5.

## 6.4 Post Operation

6.4.1 Perform post operation activities per SOP 4.1.

6.4.2 Before leaving the sampling location, verify that the appropriate samples have been collected according to the samples scheduled on the Ground Water Sampling Data Sheets.

6.4.3 Prior to sampling another site and to prevent cross contamination of equipment between locations, thoroughly decontaminate all equipment that is not dedicated according to SOP 4.5, "General Equipment Decontamination."

6.4.4 Complete the appropriate Ground Water Sampling Data Sheet and record sampling information in the assigned Document Control Logbook (SOPs 2.1 and 4.2).

6.4.5 Verify that the CoC is appropriately completed per SOP 4.2. Indicate any special instructions in the Remarks Section of the CoC. Such instructions may include a request for the laboratory to filter and preserve the sample upon receipt. Also, for wells that are listed on the sampling plan as Clean Wells or for any well that is expected to be free of contamination write, "Verify any positive detections and call _____." The blank should be filled in with the appropriate QC Chemist's name and phone number.

6.4.6 Deliver Ground Water Sampling Data Sheets and CoC forms to the SC daily. Hand carry or mail copies of the completed CoCs to the Technical Release Representative (TRR) daily.

6.4.7 The SC will retain a copy of the original forms (CoC, Ground Water Sampling Data Sheets), and provide the originals to the Data Management Team (DMT) for final archive. The SC will provide copies of the forms to the appropriate Operations and Regulatory Affairs Division Analyst, as necessary.

6.4.8 Leave routine samples and proper documentation in the environmental sample lock-box for the CAL. Field personnel will ship samples and/or distribute to the appropriate laboratories. Ensure that the samples requiring refrigeration remain at 4°C ± 2°C, but do not allow them to freeze. Always ensure that proper chain of custody is maintained.

6.4.9 Make copies of the Document Control Logbook pages (upon request) and Ground Water Sampling Data Sheets. Hand carry or mail copies to the SC and Technical Release Representative (TRR) daily.

6.4.10 The SC will deliver the original Ground Water Sampling Data Sheets to the Data Management Team (DMT) for archive. The SC will provide copies to the appropriate Operations and Regulatory Affairs Division Analyst, as necessary.

## 7.0 QA RECORDS

7.1 Ground Water Sampling Data Sheets

7.2 Document Control Logbooks

7.3 Chain-of-Custody Forms

## 8.0 ATTACHMENTS

Not applicable.